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East Europe Report

SCIENCE AND TECHNOLOGY

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26 February 1985

EAST EUROPE REPORT

SCIENCE AND TECHNOLOGY

CONTENTS

BULGARIA

ROBOT PRODUCTION LINES IN OPERATION

Budapest OTLET in Hungarian 13 Dec 84 p 37

[Article by Z. M.: "Robot Manufacture in Bulgaria"]

[Text] "A number of concrete examples could be listed to support the fact that often there is a basis for those opinions in the socialist countries according to which the Western embargoes against the East have to a large extent boomeranged onto those who would punish them in this way. For example, in the case of limits on technology transfer they have accelerated developmental programs which otherwise would have been realized at a more leisurely pace," the prestigious London FINANCIAL TIMES observes.

To a certain extent this is true of the development of the Bulgarian robot technology industry, which received an impetus following embargo measures. Originally they wanted to equip the Kama Auto Factory, the world's largest truck factory, which manufactures the Kamazes, with lifting robots and manipulators designed in the FRG. When the deal fell through 7 years ago, due to a sale ban on the western part, the Soviet Union turned to Bulgaria, where at the time they had certain electronics industry achievements but hardly any yet in robot manufacture. Today, however, the Beroe Robot Factory is in operation in Stara Zagora; it provides 80 percent of the domestic manufacture and all the robots used in the Kama Auto Factory come from here.

Bulgaria today occupies a leading place within CEMA in the development of mechanical machine manufacture and electronics; last year the rate of growth of these two sectors reached 11.7 percent, a rate far exceeding that of the other branches of industry.

Two larger lines of products were manufactured in the Beroe factory. The first contains non-digital robots, mostly lifting robots, used to perform relatively simple operations. The other series consists of the so-called "flexible," electronically controlled robots, which are suitable for performing a number of work phases. The latter includes electro-hydraulic, 350 kilogram lifting capacity equipment further developed on the basis of a Versatran license, an American firm, and several robots, originally designed by the Japanese Fanuc firm and made suitable for a number of work phases by the robot technology and cybernetics institute in Sofia or by the Paton institute in Kiev.

The Beroe factory exports 60 percent of its products, almost exclusively to the CEMA market, and it gets about 40 percent of its parts needs from the CEMA market; the value of western import is dwindling. Parallel with this--insofar as the sales possibilities there permit it--Beroe is trying to buy more western technology which can be further developed. It is true that Washington's pressure on its allies is trying to frustrate these plans, but certain possibilities remain. The Bulgarian Machinoexport has succeeded in creating a joint firm with Fujitsu Fanuc, making the first use of a 1980 law which makes possible the initiation of joint undertakings with foreign enterprises which can be realized within the Bulgarian borders.

Of course, relying on one's own resources means the most and Bulgaria is trying to support this with a very ambitious development program. As they say, they would like to produce in one or two decades what other countries achieved in 100 years. The great impetus is reflected by the fact that in the first 3 years of the current five year plan the machine industry production which includes robotics expanded at an annual rate of 10 percent. They are turning about 9-10 billion levas to industrial investment in the plan period; machine manufacture is getting one third of this and the share of electronics and computer manufacture within this is 16-18 percent. Machine manufacture will expand this year by 10 percent. The expansion of the production of industrial robots and manipulators, areas embodying leading technology, is several times this; manufacture of numerically controlled machine tools showed 66 percent growth and manufacture of the computer control units for robots and manipulators showed 30 percent growth. The percentage data faithfully reflect the dynamism, even though the quantities are still on the order of several hundreds. In the coming plan period the sum turned to industrial investment will increase by 40 percent, but in the case of some machine industry products embodying leading technology the manufacture will jump to three or five times the present level.

8984
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GERMAN DEMOCRATIC REPUBLIC

INSTITUTE DIRECTOR SURVEYS INDUSTRIAL AUTOMATION DRIVE

East Berlin FERTIGUNGSTECHNIK UND BETRIEB in German Vol 34, No 10, 1984 pp 583-585

[Interview with Dr Eberhard Vogt, director, VEB Research, Development and Rationalization of Heavy Machinery and Equipment Construction, by Prof E. Gottschalk, Magdeburg College of Engineering "Otto von Guericke": "Partners in Industry and Scientific Institutions Working on Basic Research, Application and Rationalizations"]

[Text] The anniversary of our republic is an appropriate occasion both for a review of developments up to the present and of our commitments to the fulfillment of new and higher tasks in science and technology.

A higher pace of development is required especially in heavy machinery construction and equipment construction.

The tasks of our further development include the offering of new exportable products, economy in materials and energy, as well as the creation through gradual and supplementary automation of manufacturing processes requiring little or no attendant operators. Responsibility for the solution of these problems belongs to a large extent to the VEB Research, Development and Rationalization of Heavy Machinery and Equipment Construction. In recent years that agency has been ever more in the forefront as a scientific-engineering center of this branch of industry within our republic. This has prompted us to discuss development tendencies and goals in the development of science and technology with the director of this facility, Dr-Eng Eberhard Vogt. Dr-Eng Eberhard Vogt is director of the VEB Research, Development and Rationalization of Heavy Machinery and Equipment Construction (FER).

He was born in 1942 and after graduation and completion of his training as specialized worker he studied at the Magdeburg Technical Advanced School until 1967. After receiving his diploma he was scientific assistant at the Institute for Rolling Mill Machinery and Foundry Machinery of the Magdeburg Technical Advanced School until the year 1969. In 1970 he became doctor of engineering. His thesis was on a method of determining the effect of forming in rolling mills upon the dimensional stability of the rolled material. There followed activity as scientific secretary of the machine construction section of the Magdeburg Technical Advanced School from 1969 to 1973.

In 1973 he began additional study at the Bauman Advanced School in Moscow. After that he was director of research at the Magdeburg Technical Advanced School. In 1978 he was appointed director of the research center of the Ministry for Heavy Machinery and Equipment Construction and since 1980 he has been director of the VEB FER. Dr Vogt has received many distinctions and is the author of various publications.

[Question] Comrade director, your agency has in recent years gained substantial importance in the area of heavy machinery construction and equipment construction and for other things besides and is reckoned to be an important partner of industry and scientific institutions working in basic research, applications and rationalization. What is the profile of your operation and what goals are you pursuing?

[Answer] Our operation, which was established in 1980, is a scientific-engineering center of heavy machinery construction and equipment construction and addresses itself to research and development tasks in close cooperation with the combines in our area. It is the basic aim of our work to produce a significant and demonstrable contribution to the development of productiveness and efficiency in combines and factories. We work on the basis of economic cost accounting, that is, we sell our products and attach special importance to secondary applications of our results. Thus this year we will sell for at least a half million marks scientific-technical results within the context of a secondary applications program.

Our scientific-technical aims are primarily directed toward the gradual completion of automation in heavy machinery construction and equipment construction and also toward the scientific-technical preliminaries required by these on the basis of deep analyses of international developments as well as analyses of conditions and needs existing particularly in heavy machinery construction and equipment construction. Since we believe that there exist potentialities in the development of productivity within the areas of mechanical manufacture and in assembly we have concentrated and specialized in these latter areas.

[Question] Your operation has become especially well known through your work with the machining data base. What importance do you attach to this data base?

[Answer] An important task which is also an essential outgrowth of our previous development, is the central machining data base of the metal-working industry of the GDR. We have assumed responsibility for its operation and further development. In the machining data base we have available an information center for machine shop operations which moreover is also recognized internationally for its efficiency. This data base exists to supply the metal-working industry with current technological information adapted to the high pace of evolution of machine tools, tools, cutting materials and auxiliary materials.

Application of the results of the machining data base in turning, milling, drilling and grinding (Figure 2 [Figure not reproduced]) has been demonstrated

to yield savings of more than 1.3 million hours as measured against previously standard figures. At the present time we are in process of expanding the data base by means of decentralized user-specific information systems. This means that we are turning to increase employment of microcomputer technique and that we are enlarging the primary data base and expanding the performance spectrum for new cutting materials.

[Question] In the 35th year of our republic the problems relating to the establishment of robot technology had special importance. What contribution has your collective made to this?

[Answer] In recent years, together with high performance collectives, we have devoted ourselves to investigations preparatory to industrial robot technology. We have directly cooperated in more than 90 cases of the industrial use of robots or have made our scientific-technical work available in such cases. Thus we have developed and constructed manipulating devices, specific equipment for transport processes, transloading processes and storage processes together with the corresponding palleting technique. We have also created special engineering solutions for the use of the IR 2, ZIM 60, WMR 01 and other robots. Other solutions applicable especially to the construction of heavy machinery and equipment, such as that for the IR 10E, are in preparation. After conclusion of the appropriate studies the tested and adapted robots are put into production for the consignors who commissioned our operation. We ourselves have developed only a few industrial robots for specific processes. This is because we are of the opinion that at the present point in time it is primarily the use of centrally produced industrial robot technology which we must support through our work. Moreover, it is the secondary utilization of existing developments and their application in subsequent construction which occupies the foreground for us.

In taking up new tasks it is the economic consideration which is for us the decisive point of departure. Thus in the process of decisionmaking we always first consider the question: What price must be paid for the liberation of one worker by the users of a specific engineering solution such as an industrial robot? If this question is satisfactorily answered in accordance with the known data then naturally there are additional questions to be considered such as, for example, the social effect.

[Question] During my tour I observed with interest the already practical development of a "sensor hand" for a robot which loads machinery with workpieces. In your industrial developments are you also attempting to produce this sort of thing, the "manipulator in a box"?

[Answer] Yes, it is true that the development of a sensor-equipped manipulator is intended for a concrete application but nevertheless it is universally exploitable secondarily.

[Question] Robots are an important prerequisite for the creation of manufacturing processes requiring few workers. From our joint work in the research community I know that the problems of manufacturing processes involving few workers play a great role with you.

[Answer] On the basis of our experience in the use of industrial robot technology we have necessarily entered the very complex area of minimal worker manufacturing and have cooperated in such projects as the IGFA ROTA of the Karl Liebknecht VEB Heavy Machinery Combine in Magdeburg, the industrial robot center of the VEB Magdeburg Armature Plant and the TEROMA project in the Wernigerode VEB Transmission Plant. This cooperation ranged from the preliminary operations to the final acceptance of the project. This mode of working is one which we shall retain and further expand since it has proven its worth. For heavy machinery construction and equipment construction with its typical small-scale production and medium mass production flexible automation to an increasing degree on the basis of available automation technology offers possibilities for a transition to minimal worker manufacturing. And thus there is opened up the possibility of a significant increase in productivity. Here we see a wide field for our future work. Thus at the present time we have turned our attention to the preparation of flexibly automated work units in the manufacture of prismatic parts. At the same time we do not overlook the importance of an effective production organization corresponding to the existing technical and technological level. And in this area, too, we have begun addressing appropriate tasks within the framework of our capacities. In so doing we proceed from the opinion that the production increases made possible by modern automated manufacturing are fully effective only when preliminary and follow-up processes are optimally configured under the conditions of heavy machinery construction and equipment construction. To summarize: it is a question of creating engineering solutions possessing high adaptability to rapidly changing production requirements.

In developing this engineering solution with all its implications for the future we look upon the attainable economic utility and the degree of novelty of our results as a single unit and therefore have given great attention to patent law and to the establishment of patents. With 100 advanced school cadres and technical school cadres we have at the present time obtained about 20 patent applications. These patent applications relate to new uses of microelectronics in process automation.

[Question] You have referred to microelectronics. What is your view of the use of microelectronics in heavy machinery and equipment construction?

[Answer] In consequence of our own scientific-technical work and on the basis of requirements of the national economy we have given our attention to questions arising in the application of microelectronics and microcomputer technique. This began as a result of the absolute necessity for automated measurement acquisition and measurement processing in the machining data base. With the engineering solutions developed by us, e.g., in applying the sensor technology to our "turning operation" guide value machine (Figure 3), we ran into possible areas of use for the CCD line camera which we developed and built and we also encountered new needs, for example, the surveillance of tools in turning. At the present time we are working on these problems jointly with the machine tool industry and with users in several areas and by working on this problem we are also making a contribution to setting up minimal labor operation. We have also taken on additional tasks relating to the application of microelectronics to quality control in mechanical processing

and to the optimal guidance of machines and equipment. The response to our first results in the application of microelectronics was so great that we established the microelectronics applications center for heavy machinery and equipment construction. To make this research group even more effective we have combined it with the consultation support units of our operation in the area of robot technology and microelectronics.

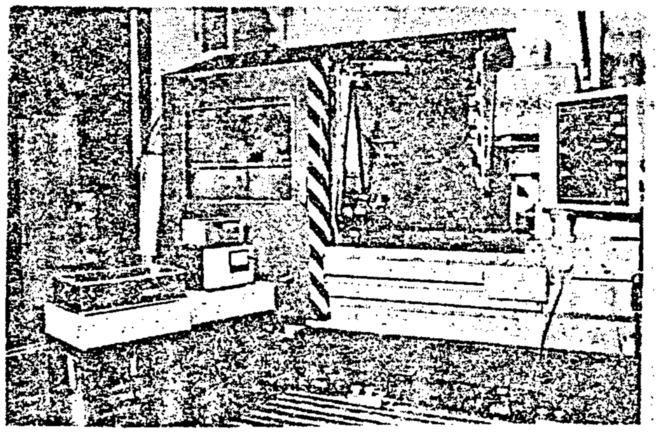

Fig. 3. The "turning operation" guide value machine equipped with sensors for tool surveillance in the machining data base experimental center.

In the studies of our applications center we are concentrating upon the development and the construction of simple economical control technology on the basis of the structural elements which are produced in the GDR and we are to an increasing degree concentrating on the development of software for the microcomputer technology which is available to us. Our experience in sales also confirms the internationally recognized tendency for the cost of software to steadily increase with the introduction of computer technology and modern control methods.

[Question] The rapid development of science and technology requires the close cooperation of factories, scientific-technical centers, advanced school facilities and the academy of sciences. What importance does scientific cooperation have for you?

[Answer] In addition to the focal points of our work of which examples have been mentioned we perceive as an ultimately decisive condition of success the assurance of scientific-technical advance in the area of rationalization, which as is well known is more and more becoming characterized by automation, such rationalization is to be achieved in the construction of heavy machinery and equipment through a close and carefully planned cooperation with the facilities of the academy of sciences and of the advanced schools. Also we are continually expanding international scientific-technical cooperation and are cultivating particularly close cooperation with scientific institutions in the USSR.

Close scientific cooperation with facilities of the academy of sciences and of the advanced schools is for us an indispensable constituent of our work. Since the beginning of our activity, e.g., with the machining data base, we have been able to accumulate most valuable experience with scientific cooperation.

Of decisive importance for the success of scientific cooperation is a concrete and comprehensive statement of the problem in a form which takes into account the capabilities and circumstances of the participants. I should like to emphasize our cooperation with the Magdeburg Technical Advanced School, with the Technical University of Dresden and with the Central Institute for Cybernetics and Information Processes in the academy of sciences. Cooperation with leading scientists is for us indispensable especially in the process of locating a problem and of working up its solution.

Joint research communities are significantly influenced by these scientists and are guided by them toward an effective scientific-technical cooperation. Such organizational forms, e.g., research communities, paired with joint pursuit of success in scientific-technical work represent an important basis for our own work which we shall also nurture and expand in the future.

[Question] Comrade director, in the name of the editorial staff we thank you for this conversation and wish success in your work to you and to your collective.

8008
CSO: 2302/45

GERMAN DEMOCRATIC REPUBLIC

DEVELOPMENT OF '7 OKTOBER' MACHINE TOOL COMBINE REVIEWED

East Berlin FERTIGUNGSTECHNIK UND BETRIEB in German Vol 34, No 10, 1984 pp 586-589

[Article by Dr H. Naumann, Berlin VEB "7 Oktober" Machine Tool Combine]

[Excerpt] The VEB plant "7 Oktober" for the construction of heavy-duty lathes has developed into one of the most important export operations in the area of machine tool construction in the GDR both for the socialist economies and the nonsocialist economies. In 1967 machine tools of this plant entered 28 of the world's countries. Undoubtedly that was in 1969 an important consideration in making the decision to establish this operation as a primary operation of a large industrial combine for the construction of machine tools processing rotationally symmetric workpieces: a primary operation of the Berlin VEB "7 Oktober" Machine Tool Combine which itself represented an enlargement of the grinding machine combine which had been formed 1 year previously.

Control of the combine was assumed by Comrade Wolfgang Biermann who since 1 March 1963 as technical director and later as plant director had played a decisive role in turning the behind-schedule "problem child" of the Berlin party organization, the VEB Heavy-Duty Lathe Construction Plant "7 Oktober," into a reliable partner of the national economy.

Thanks to the firmness of his political principles, his hard-earned high level of specialized knowledge, his enormous personal involvement and his activity as a leader the Berlin VEB "7 Oktober" Machine Tool Combine developed into the leading combine in the area of machine tools and tools. The important features of the combine in the 5-year plan for 1971 to 1975 were its exemplary scientific-technical achievements, its high rates of increased production, its strengthening of our exports through long-term agreements with our principal trading partner the USSR and through sales of machine tools to plants in the nonsocialist economic area for their principal production activities. All of these constituted a contribution by the machine tool builders to fulfillment of the resolutions of the 8th SED Party Congress and such achievements have been distinguished by granting of the Karl Marx Order on 2 February 1974 to the Berlin VEB "7 Oktober" Machine Tool Combine. At the start of this 5-year plan the decision was also made to terminate the production of vertical turret lathes after more than 70 years of such production and to turn to specialization in favor of the USSR. Instead, strong emphasis would be given to the

production of multispindle automatic lathes in this combine. To this end heavy investments were put into this primary operation. A large assembly shop was constructed, the machine shops were equipped with the most modern numerically controlled large-scale processing machines, particularly those supplied by the CSSR. And there was also carried out industrial testing of numerically controlled machine tools from the USSR in the area of small-scale machinery. Within the combine there was created a complicated process of labor division which resulted in a fivefold increase in the production of multispindle automatic lathes.

In the 5-year plan for 1976 to 1980 the primary plant tested the marketability of its new designs for tooth-flank grinding machines and achieved a broad extension of its export activity. Another factor which was characteristic of the development of this operation in these years was the building of a large machine system for the complete processing of gears in the Slovak city of Trencin and the start of a still larger system of this type in Polish Huta Stalowa Wola (Figure 4 [Figure not reproduced]). At the end of 1976 there began the development and planning of one of the most important rationalization projects of this operation, namely the creation of a so-called integrated manufacturing system in the domain of small-scale machinery (Figure 5 [Figure not reproduced]). This manufacturing system was put into operation in 1981 by Konrad Naumann, member of the Politburo of the SED Central Committee and first secretary of the SED district leadership of the capital city. The manufacturing system represents a modern method of small-scale machinery manufacture in which the manufacturing process, the storage process, transport process and production control are linked together with the aid of machine data processing and monitor screen technology. The highest quality standards are enforced by competition in the nonsocialist economic market and by the demands by customers for specific engineering solutions in the products of this operation. The products referred to here are tooth-flank grinding machines for gears having a mass of more than 20 tons and diameters over 2 meters. On 27 June 1979 this primary operation received the ASMW diploma as an "operation with workmanship of excellent quality" and it has successfully defended this seal of quality to this day.

On 7 November 1982 it was the 30th anniversary of the day when this operation received the name "7 Oktober." The 65th anniversary of the Great Socialist October Revolution on the same day was moreover a high point of friendly association with Soviet Army units, with the "Unter den Linden" School conducted by the USSR Embassy in the GDR and with the Moscow machine tool factory "Sergey Ordzhonikidze."

Recognition of Achievements

Thirty-five years of "7 Oktober" machine tool plant operation in Berlin-Weissensee--that represents at the same time 35 years of what has often been very hard work, struggles with problems, successes and failures, joy and annoyance. But these have also been 35 years in which the capability of socialist machine tool construction was proven, in which cadres have been trained for this branch of industry in the GDR and for Berlin industry. Numerous high distinctions were conferred upon collectives and individual personalities of the operation. The workers are proud especially of these distinctions which the

entire plant collective has received and which shall be here mentioned as representative of all the other honors:

i. Honor Banner of the Central Committee of the SED on the occasion of the 20th anniversary of the GDR on 7 October 1969,

ii. Honor Banner of the Central Directorate of the Association for German-Soviet Friendship on the occasion of the 30th anniversary of the liberation on 8 May 1975,

iii. Thaelmann-Pieck Honor Banner of the Central Council of Free German Youth on the occasion of the National Youth Festival on 31 May 1979,

iv. Ernst Schneller Honor Banner of the Central Directorate of the (Paramilitary) Society for Sport and Technology on the occasion of its 30th anniversary on 6 August 1982,

v. Honor Banner of the Central Directorate of the Society for German-Soviet Friendship on the occasion of the 12th Congress of the Friendship Society on 11 November 1983.

8008
CSO: 2302/45

GERMAN DEMOCRATIC REPUBLIC

DEVELOPMENTS IN GDR METAL FORMING TECHNOLOGY ASSESSED

East Berlin FERTIGUNGSTECHNIK UND BETRIEB in German Vol 34, No 10, 1984
pp 590-591

[Article by B. Sickel, engineer, Erfurt VEB "Herbert Warnke"]

[Text] The Erfurt VEB "Herbert Warnke" Forming Technology Combine is worldwide among the six largest producers in this field. It is an internationally recognized operation which looks back on an 84-year tradition.

Socialist development in the GDR, planned economic cooperation with the Soviet Union and the countries of CEMA have provided the prerequisites necessary for stable dynamic development oriented toward output and export and serving the interests of the people and of peace.

In the period 1946 to 1953 a model socialist operation was developed. This was the SAG operation, "Henry Pels" Erfurt, which was developed under the leadership of Soviet specialists with the support of the progressive efforts of its workers. These included a small number of engineers coming from a plant which at that time was producing hand carts, woodworking machines and hand-lever shears.

In 1950 the staff already included 2,000 workers, engineers and economists. With 55 new press models, 25 different pieces of rolling equipment and 27 different shears the plant was given an entirely new profile. It was equipped as a productive, export-oriented operation on an appropriate material-technological foundation.

The redesign and expansion of the operation was linked to an improvement in working and living conditions. For the first time there were created for the workers the requisite social, medical, recreational and cultural facilities together with arrangements for good professional training. Thus at the end of 1953 there was placed in the hands of the people an efficient plant oriented toward the future and staffed by competent cadres: the VEB Press and Shear Construction Factory.

Since the seventies there has taken place a stormy development in the growth of productive and exporting power and in the mastery of scientific-technological progress.

Today there are manufactured 6,000 machine tools in 130 models and 300 sizes annually. In 30 countries of the world these machines are employed as individual machines, as engineering solutions to special technological problems, as an automated manufacturing complex or as an automated manufacturing production line. They are employed in sheet metal forming and in the shaping of massive materials, in working plastics and elastic materials, in modern large-scale production and mass manufacture and also in small production line manufacturing processes.

The export volume amounts today to 95 percent of machine production. And over 55 percent of it is destined for automated equipment and complete technological systems for special customer requirements. The most important trade partner is the Soviet Union which consumes 70 percent of the export volume. The combine is linked with the Soviet Union through 64 years of extensive trade relationships.

The forming technology combine has expanded its scientific potential by a factor of 2.5 and has oriented that potential toward high level and high speed standards of quality. Today every fifth worker is the product of an advanced school or a specialized school. Of these workers, 2,500 are active in research and development, design, technology, planning and computer technology.

This capability is strengthened through planned cooperation with 45 institutes, advanced schools and specialized schools, research institutions and factories within the GDR. An important source of this accelerated tempo in the use of science and technology is the "GDR/USSR/CSSR Joint Design Office" which has been in existence since 1973. It combines the potential of 23 leading institutions and plants of the partner countries and has accelerated development of high-quality products.

Innovation rates of 25 percent, increases in serviceability up to 250 percent and improvement in the mass-performance ratio up to 60 percent are results of socialist community effort. New and more advanced developments are a 75-percent rate of peak performances--a rate developed in fewer than 24 months and carried over into production. In every second machine tool there are being installed a growing assortment of product-related robot technology and modern microelectronic controls for the most varied technological requirements. For the design of important structural groups 550 patents have been newly granted since 1976 and products of the combine have received 66 gold medals and diplomas at international fairs. In 9 countries 23 licenses have been granted by the combine to leading internationally recognized companies.

In the period following the 7th SED Party Congress there has been created a modern material-technological foundation corresponding to the high demands imposed by machine construction in this area of manufacture. Characteristic of the technological level of this combine are its pioneering technologies and its orientation toward minimal staffing operation. For example:

i. the PC-3 processing center for heavy prismatic workpieces,

ii. the integrated job-specialized manufacturing division for producing rotationally symmetric workpieces,

iii. the NC-controlled high-performance portal technology,

iv. computer-assisted design, computer-assisted manufacture--CAD/CAM,

v. modern work sites.

Today 60 percent of the value of the production equipment consists of

i. NC technology, automation technology, robot technology and

ii. electronic computer technology.

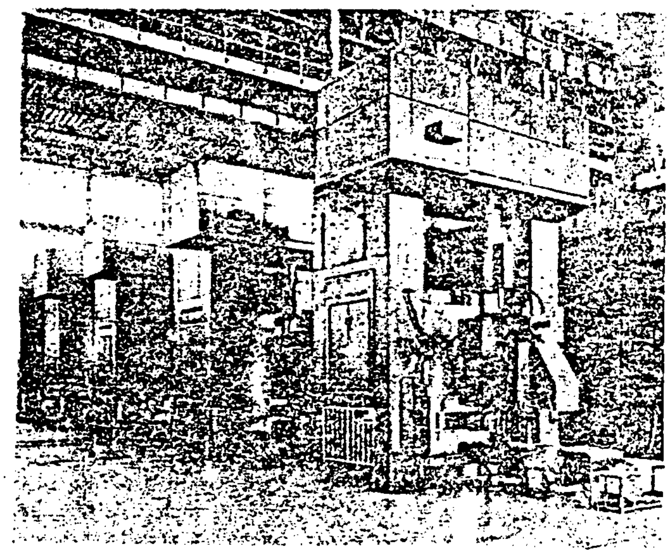

Fig. 1. Automated press line.

This development, with broad socialist rationalization and intensively expanded plant and equipment was a high political, scientific-technical challenge to the engineers. The challenge was met by engineering and economic results remarkable in their quality.

The Erfurt "Herbert Warnke" Forming Technology Combine has proven itself in the world market to be a capable and reliable partner and enjoys recognition and appreciation as a large-scale socialist operation.

The products of the combine are being used successfully in important community projects of the CEMA countries, in investment projects and redesign projects in the automobile manufacturing, agricultural machinery manufacturing, consumer goods manufacturing and other branches of industry in the fraternal countries as well as in leading concerns and firms of the capitalist countries.

This development, designed to serve the needs of the people, was and continues to be most closely linked with the future and the growth of the GDR. The workers of this forming technology combine with their political engagement,

their hard work and their creativity have shared in the shaping of the history and international reputation of the socialist GDR.

Fig. 2. PD2-HH 400 x 250 electronic press.

For its outstanding performance in the building of socialism this factory collective has been honored with such high national distinctions as the "Karl Marx Order," the "Banner of Labor" Order and others.

8008
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GERMAN DEMOCRATIC REPUBLIC

NEW PCB PRODUCTION CENTER FOR ROBOTICS APPLICATION

Halle FREIHEIT in German 9 Nov 84 p 10

[Article by Juergen W. Boehme]

[Text] Across the board, through all branches of industry there is in every discussion one fundamental consideration: How can the productivity of labor be noticeably increased? And wherever this is the subject of conversation inevitably the talk comes around to one decisive factor in the increase of production, a factor which is gaining more and more importance. That is in-house production of rationalization devices. In many places there has already been success in significantly raising the scientific-technical level of the construction of rationalization devices with an overall increase in output capacities. In this process it has been possible increasingly to create more industrial robots and applications of microelectronics by using one's own factory capacities.

In the "Wilhelm Pieck" Mansfeld Combine today in complex rationalization projects it is necessary to use only about 15 percent of external cooperative production. Eighty-five percent of such equipment is produced in the combine's own facility for plant and equipment construction. In the automation operation of this facility 80 percent of the engineers are specialists in microelectronics, MSR technology and programming. In this facility apparatus is created which assures that the individual combine operations can meet their national economic tasks ever more effectively and at the same time can continually improve the working and living conditions of the mineworkers and foundry workers.

The most recent example of the way the Mansfeld combine produces in-house its own rationalizing devices, especially in the area of electrotechnology and electronics, may be found in the Center for the Manufacture of Circuit Boards for Specific Rationalization Procedures in the Mansfeld combine. This center was put into operation just before the anniversary of the republic. The center also comes within the province of the Ministry of Mining, Metallurgy and Potash. The circuit boards manufactured here are required especially for industrial robot controls, microcomputer controls and additional automation projects aiming at completion of the "Program for the Complex Renovation of Mining and Foundry Operations." This promises to pay off in the future since further developments in "custom" technology mean a growth in productivity, and hence the performance of the combine operations, creates further potentialities

for consumer goods production and thus leads to improvements in output on a national economic scale.

With the initiation of operations in the circuit board center there have been created the essential prerequisites for the rational and effective manufacture of future-oriented rationalization techniques to meet the needs of the combine and to meet needs existing elsewhere. Reiner Becker, group leader in circuit board manufacturing, explains that "this includes such engineering solutions as the Mansfeld process controller, programmed industrial furnace operation, industrial robot controls with broad areas of application. It also includes further forms of hardware for use in microcomputers."

The printed circuit boards are designed by the development engineers and designers themselves. In this process rational procedures have been found for such activities through cooperation and information exchange with the facilities and institutions of the Ministry of Electrotechnology/Electronics.

After that the manufacturing blueprints are worked up. Now begins the work of the 13 colleagues in the printed circuit board center. The circuit diagrams drawn on the drafting boards of the designers are used as data for a digitalizing device. The device evaluates the coordinates of the circuit board and produces a punched tape for a computer-controlled precision drafting automaton. The latter draws the circuit diagrams on a photographic plate which is used to make a contact copy. The circuit board base material is painted with a solid or liquid photoresist and irradiated with ultraviolet light. This renders the circuit diagram on the plate visible. The drillholes are produced using a computer-controlled coordinate drilling automaton for which the controls are developed and manufactured by in-house workers. This automaton drills three circuit boards in a stack. This process takes 36 minutes to carry out 1,000 drill-lifts--corresponding to 3,000 holes. Manual drilling with a conventional drill machine requires 276 minutes for this operation.

The circuit board center of the Mansfeld combine, functioning as a component of centralized construction of rationalization devices makes the following declaration: the better and the more efficient the in-house construction of rationalizing devices the greater will be progress in intensification of labor and in consequence the greater will be the profit for us all.

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GERMAN DEMOCRATIC REPUBLIC

INCREASED USE OF CNC IN MACHINE TOOL CONSTRUCTION

East Berlin FERTIGUNGSTECHNIK UND BETRIEB in German Vol 34, No 11, 1984
pp 646-647, 676

[Article by Dr R. Waetzig, engineer, Research Center for Machine Tool Construction in the Karl-Marx-Stadt VEB "Fritz Heckert" Machine Tool Combine]

[Text] 1. Automation Is Increasingly Determining the Quality Level of International Machine Tool Construction

While in the year 1980 machines having a low level of automation and employing relay/contactor controls were still in wide use, the most recent expositions have been showing a substantially different picture. The Fifth European Machine Tool Exposition in Paris in 1983, for example, indicated a distinct trend toward the use of microelectronics. The dominant theme for capitalist industrial countries, in the face of a general slippage in sales by 15 to 20 percent, has been the emergence of highly competitive new technological developments introduced by the leading manufacturers. The CEMA countries also demonstrated their capability with a number of new developments. Since the Fourth European Machine Tool Exposition the tempo of technical progress has visibly increased, the most important trend here being the complex employment of machines, industrial robots, automated transport systems and automated storage systems in flexible manufacturing systems employing microcomputer controls. It is expected that among the leading manufacturers these systems will account for 20 percent of sales with further increases in the offing. For small and medium mass production the following gains in efficiency have been targeted:

i. cost reduction by 30 percent,

ii. equipment utilization amounting to 80 percent of the calendar time,

iii. savings of 60 percent in labor forces and unmanned night shifts,

iv. a quality increase of 30 percent.

It is expected that these goals will be achieved through automation of 85 percent of the processes of production through the use of microelectronics and industrial robot technology.

2. Increasing Levels of Automation Through the Use of Microcomputers

The increasing degree of automation resulting from the use of microcomputers has been especially evident in the individual machine tools. The fraction of machines possessing numerical and programmable microelectronic controls has further increased (Figure 1) and is approaching 90 percent.

Numerical controls--mainly as CNC--have affected all types of machines, including grinding machines and gear-cutting machines and shaping machines. Modern CNC controls are characterized by the following features:

i. multiple microcomputer systems having 8- and 16 (32)-bit path lengths giving them high processing speeds,

ii. high storage capacity for operating systems of control and for workpiece programs up to 256 Kbytes,

iii. modern computer operating designs making use of color displays and foil keyboards,

iv. extensive diagnostic programs for locating errors and for quality control,

v. multiaxis controls (up to 18 axes!) for multisupport machines including a setup system and disassembly system for tools and workpieces as well as measurement stations.

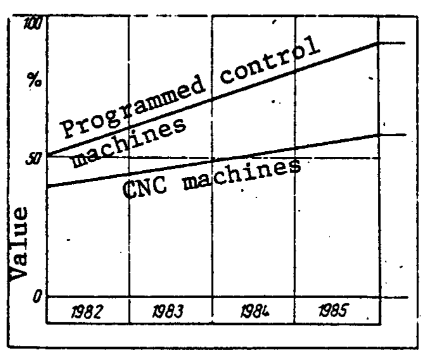

Fig. 1. Ratio of numerical and programmable machine tool controls (CNC/PC).

Fig. 2. UNICON 130 drilling and milling machine of the VEB UNTON Gera; plant of the VEB Machine Tool Combine "Fritz Heckert," Karl Marx City. [Photo not reproduced]

The machines exhibited by the GDR machine tool combines were equipped with control systems produced by the VEB Numerik "Karl Marx." These were such controls as CNC 600; CNC-H 640; IRS 600 and PC 600 or with foreign control systems employed at the request of the customer. Figure 2 shows the UNICON 130

drilling and milling machine of the VEB Gera Machine Tool Factory, an operation of the VEB Machine Tool Combine "Fritz Heckert," Karl Marx City.

Together with the FRG Siemens factory the internationally leading CNC manufacturer, Fujitsu Fanuc, Japan, controls about 75 percent of the capitalist CNC market. A new development was the increased degree of modularity, by means of which it is possible for the electronic components to be built into the machines by taking advantage of progress in miniaturization and reliability. Thus separate control panels are becoming a rarity. Reliability has substantially increased (mean time between failures up to 5,000 hours between two breakdowns). CNC industrial robot controls have developed a software which deals with special features (higher speeds up to 1 m/sec with more stable mechanical construction and higher interpolation forms). Punched tape has retained its importance in CNC. Programming of the workpieces is done either directly at the machine or in the technology. The machine programming has been very much facilitated through geometry processors and symbol keys which make it possible to select subprograms (several operations) and to make them visible, in parallel to the processing operation, on the monitor screen--in part multidimensionally. At the same time help is provided in text form on the screen for the operator. This text can be generated in several languages.

3. Equipment of the Mass Production Machines

The equipment of the mass production machines has also increased its use of programmable electronic controls and the traditional relay controls have been largely displaced. These programmable controls are used both in the automation of contact-controlled machines and also in combination with CNC. Table 1 shows a survey of the programmable control processing principles. A measure of the complexity of a control task is the number of inputs and outputs of a programmable control and also its processing performance, e.g., reaction time to a change in an input signal. Table 2 shows three size classes with typical parameters for small, medium and large machine tools. Of great importance is a rational programming technique. For this there are three types of device available. For startup operations and for servicing purposes some simple devices with LED displays are being used which are programmed directly in machine code. Higher requirements are met by a portable monitor which accepts the three standardized (e.g., descriptive forms of logical connectives: Boolean equations; switching symbolism and instruction lists. The corresponding GDR devices PRG 600 of the VEB Numerik "Karl Marx" for the PC 600 machine controls permit comparable solutions. Programmable controls also require rapid further developments in the direction of higher storage capacity and shorter reaction times as well as reduced volume and reduced power requirements. These controls are also used for many other control tasks in general machine construction as well as for the lower levels of manufacturing controls on the scale of a small computer.

4. Manufacturing Controls or System Controls for Factory Automation

The manufacturing controls or system controls required in factory automation with extensive software packages involving many Mbytes consist of several levels within a hierarchy with specific functions being assigned to each level.

In general, at the Fifth European Machine Tool Exposition the displayed exhibits were in the area of factory accounting (commercial and accounting programs), the area of manufacturing management (planning; machine programming) and real time manufacturing control for DNC operation, storage and transport. In addition, there were exhibits in the area of economic planning and in the area of direct work progress reporting. In this connection it is principally small computers and microcomputers which are employed equipped with 16-bit path length 128-Kbyte work storage and extensive peripherals (disks; displays). A modern element was the use of magnetic bubble storage. The know-how of particular manufacturers is employed as a sales argument which manifests itself in software. Software costs take up as much as 60 percent of the total costs while hardware costs have continued to drop.

Table 1. Programmable Controls for Machine Tools and Industrial Robots

Requirement	Bit Processing Logical Function		Word Processing Arithmetic Function	
Solution principle	Bit processor discrete	Microprocessor integrated	Word microprocessor	Slice microprocessor
Speed	High	Low	High	Higher
Function content	Low	High	High	High
Developer cost	H high S minimal	H minimal S high	H high S high	H high S maximal
User cost	Low	Low	High	Low

H = hardware; S = software.

Table 2. Programmable Controls (Typical Construction Stages)

Parameter	Programmable Controls: Small	Medium	Large
Number of inputs/outputs	16	256	To 5,000
Speed	10 msec/K	5 msec/K	0.5 msec/K
Memory capacity (EPROM Kbytes)	1K	4K	To 64K
Bit processing	X	X	X
Word processing	--	X	X

Very definitely included in the complete automating equipment of machine tools are drives and systems of path and angle measurement for tool advance drives in position control. Continuous primary control and advance control has developed into a standard form of equipment with the dominating role being played by direct current drive. There are also featured further reduced volumes for the final control elements (thyristor regulators in 2- to 6-phase circuitry, transistor pulse regulators) by means of improved power electronics and also by means of DC motors using new magnetic materials (CoSm) which achieve positioning ranges up to 1:100,000 (e.g., 0.1 μm/min up to 10 m/min in grinding machines). This latter highly developed technology is encountering

some competition in regulated AC drives. These have made use both of regulated asynchronous motors with reduced dynamics and a small total range of controller output. They have also used synchronous machines with electronic commutation for higher demands, but also at about 30-percent higher cost. The advantages of the wear-free work and more favorable parameters are counterbalanced by increased costs which lead one to expect a longer introduction phase.

5. Sensors and Measuring Systems

Sensors and measuring systems of all kinds have become an indispensable constituent of machine tool automation. Their components such as measuring base, transducers, measuring electronics and internal measurement processing have been extensively further developed and are being employed for many physical quantities. The foreground continues to be occupied by path-measuring and angle-measuring systems of high resolution (up to 0.1 μm; up to eight decimal places) for installation into the machines and into industrial robots. Their functional reliability has been further increased (mean time between failures up to 10^4 hours) with the scene being dominated by proven inductive measuring systems such as resolvers and inductosyn scales in conjunction with reliable built-in incremental photoelectric pickups. The use of microelectronics has made progress in the integration of measuring electronics in integrated or hybrid switching networks. The extent of the programs for the evaluation of measurement results has increased substantially (up to 60 Kbytes) since it is possible to use path length and angle output data to draw inferences for workpiece tolerances, tool condition and machining accuracy. Especially widespread employment has been found in almost all highly automated cutting machine tools by 3-D scanners (switching or measuring) which permit control of the workpieces, tools, equipment and machine parts in an automatic cycle. They represent an integration of the principles of a measuring machine into a machine tool but without achieving the full precision of a measuring machine. To achieve precision, e.g., in grinding machines, NC measuring controls are typical.

In addition to paths, measurements are made of forces, turning moments and power in order to determine the state of the machine and also the state of the entire processing operation. To this end there are used current and power measurements in the control panel for primary drives and/or prepared roller bearings equipped with strain gauges for measuring bearing force. While it is true that one does not in this way reproduce the adaptive control tests of earlier years, which failed for economic reasons, nevertheless one does attain a reliable automated operation without supervision and without personnel. The use of this equipment is also associated with measurement processing by means of microcomputers. Newly in use are pattern-recognition systems for workpiece identification for the purpose of program and tool selection. These are admittedly still quite expensive.

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GERMAN DEMOCRATIC REPUBLIC

RELIABILITY OF DNC SYSTEM EXAMINED

East Berlin FERTIGUNGSTECHNIK UND BETRIEB in German Vol 34, No 11, 1984
pp 648-651

[Article by Dr J. Schaller, Dresden Technical University, Manufacturing Technology and Machine Tool Division]

[Text] 0. Introduction

Since the middle of the sixties there has been taking place a process of integration between information technology and numerical control technology and this is leading to various levels of quality in control, such as CNC--computerized numerical control, DNC--direct numerical control. The historical date of birth of DNC can be rather precisely established [1]. The development of CNC even in its early stages began with sharply differentiated engineering solutions. The early experts treated DNC and CNC as alternative strategies. Necessarily, direct numerical control had nothing equivalent to compare with the impressive advantages of the stored program NC. Even the convincing exhibit by the GDR at the Leipzig Spring Fair of 1973, the DNC-CONCEMA [2] with 14 different NC machines from 5 countries of the CEMA and 9 different types of control, was unable to effect any change. Toward the middle of the seventies the uncertainties and the perspectives of DNC were greater than ever.

All the more remarkable therefore was the ROBOT '77 exhibit in the Moscow Sokolniki Park in 1977 when the GDR appeared with a highly developed DNC exhibit [3] and Japanese exhibitors drew attention to a tabular summary describing the use of 70 DNC systems. More receptivity to DNC was also discernible in the specialized literature [4-6]. This receptivity is linked to the clear separation of performance criteria and integration forms in the new NC generation.

1. Decision Criteria for DNC

In 1979 the VEB ZEMAG Zeitz, a plant of the VEB Heavy Machinery Combine TAKRAF, put a DNC system into operation by stages. During the studies involved in preparation for the use of such equipment there were already the beginnings of argument over DNC. Questions regarding motivation and regarding confidence in the direct numerical control process arose at this time. The most substantial arguments were provided by the production profile and the high export obligations of the factory.

The VEB ZEMAG Zeitz is producing rotary caterpillar cranes with carrying capacities of 25, 28, 30 and 40 tons and also universal dredging machines. Besides, as general contractor for complete briquette factories of the CEMA and also for potash granulation facilities it is continuously confronted by manufacturing organization problems of large-scale and small-scale mass production as well as such problems in the manufacture of individual items. Special transport engineering regulations strengthen adherence to schedule in sales. The requirements with respect to parallelism and rhythmicity of manufacturing during different types of mass production require a flexible, mobile and variable manufacturing organization. The NC machines set up in decentralized mode in accordance with the product principle underscore these criteria. The high productivity of the NC machines moreover require an NC organization form involving low-loss NC programming, high data reliability and simple data manipulation. In a study conducted with the research center of the machine tool construction branch of the "Fritz Heckert" Machine Tool Construction Combine it has been established that DNC meets these requirements most advantageously [7].

2. Construction and Function of DNC Systems

2.1. General Structure

The general structure of DNC systems has already been characterized in [1] by

i. a central computer,

ii. one or more central or noncentral coupling elements,

iii. noncentral DNC supplements at the NC machines.

By subdividing control functions between the DNC computer and the NC control units as well as by the arrangement of the data transmission channels it is possible to introduce modifications into the structuring (Figure 1) [8]. International pilot engineering solutions have also emerged in accordance with these. The DNC-CONCEMA development is characterized by

i. star-shaped/aggregated lines,

ii. BTR.

This structuring principle has in the meantime been preferred in many internationally known DNC systems.

2.2. The DNC-ZEMAG System

The DNC-ZEMAG system is constructed in accordance with the DNC-CONCEMA principle. Data transmission to the 15 connected NCM is in real time operation. The configuration at the time of inauguration of operations already encompassed five types of turning and milling machines as well as processing centers having five different control types (Figure 2). In the meantime a technological unit has been integrated employing out-process measuring equipment. Expandability is established user-specifically with 40 NCM.

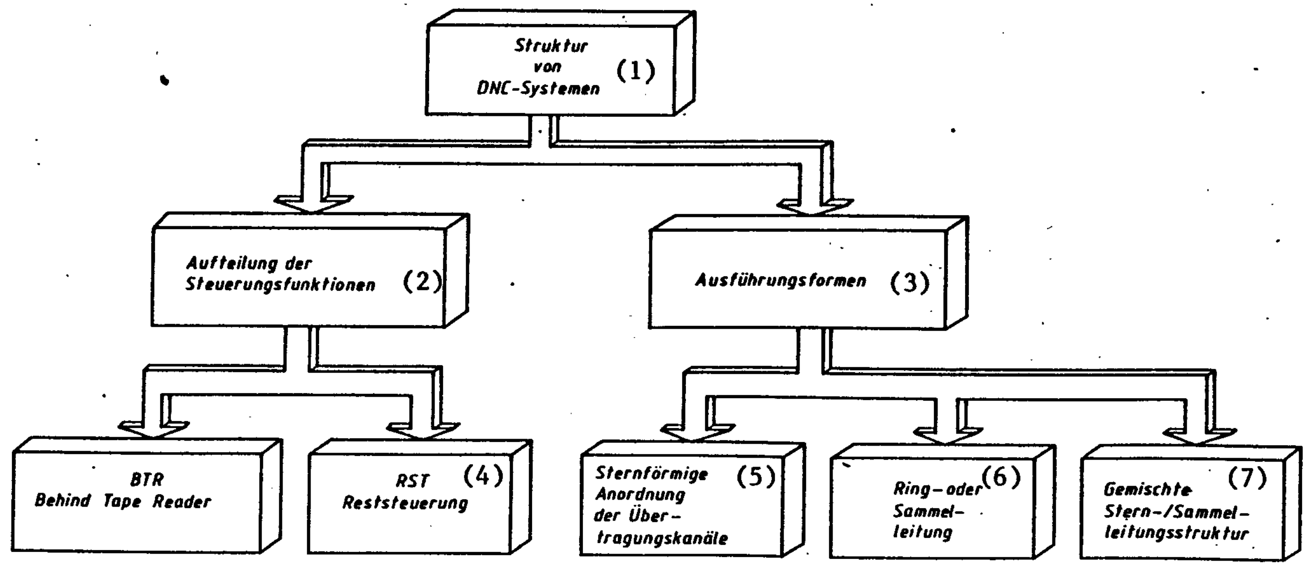

Fig. 1. Hardware variants of DNC systems.

Key:
1. Structure of DNC systems
2. Classification of control functions
3. Design forms
4. Residual control
5. Star-shaped arrangement of transmission channels
6. Annular arrangement or aggregated arrangement of leads
7. Mixed star/aggregated lead structure

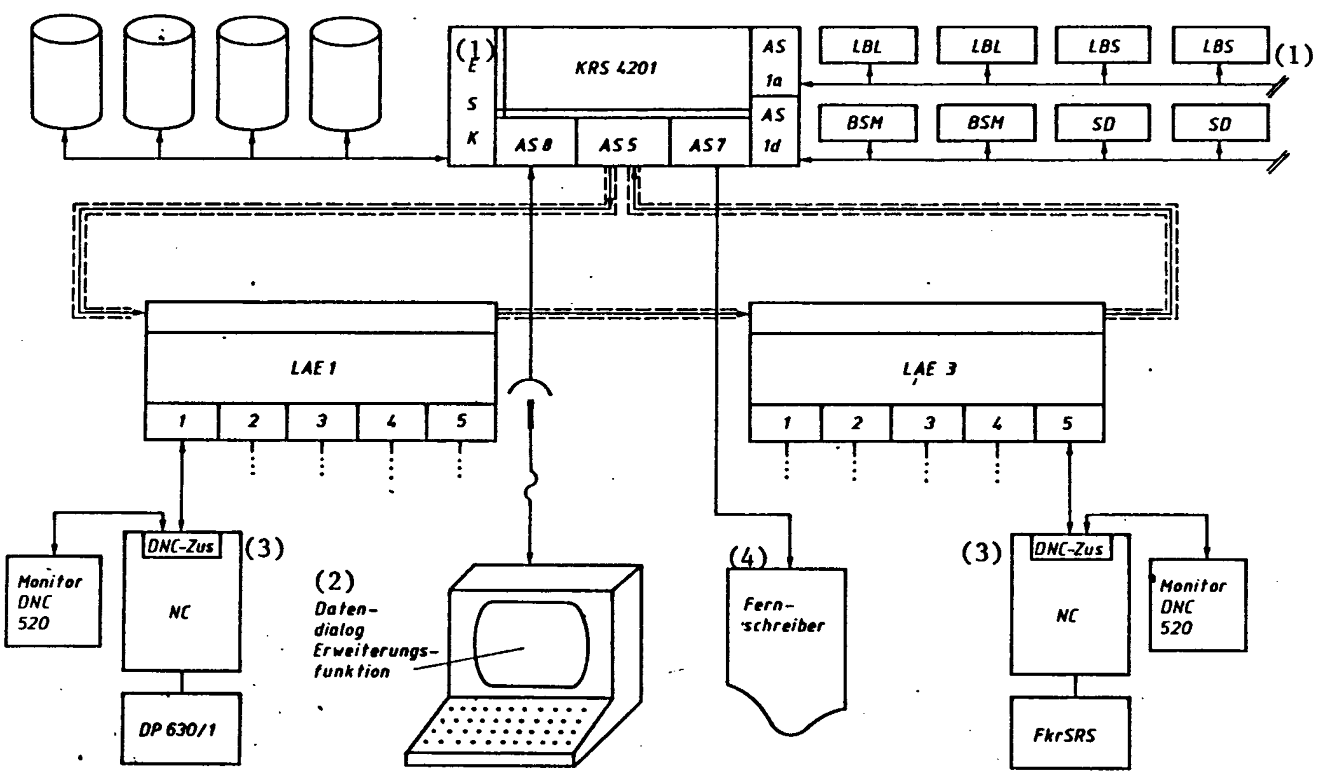

Fig. 2. Structure of the DNC-ZEMAG system.

Key: 1. [See glossary]
2. Data-dialogue expansion function
3. DNC-Supplement
4. Teletype

2.3. Function

DNC functions are differentiated in general in accordance with Figure 3 [9-11]. Selective areas of the basic function and the expanded function serve jointly for:

i. the derivation of process guidance quantities,

ii. the image guidance of process developments and consumption parameters,

iii. diagnostics and prophylaxis.

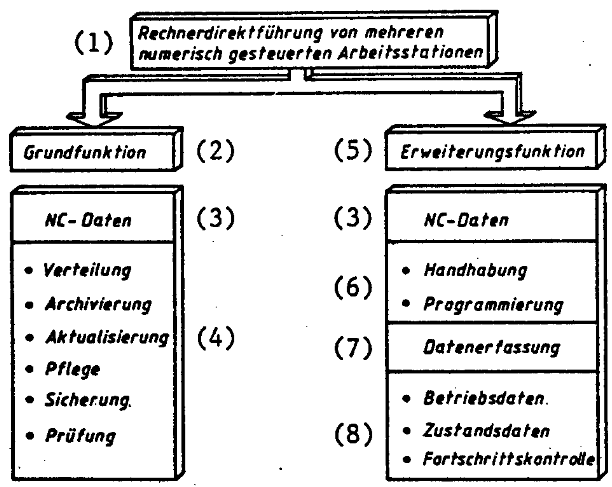

Fig. 3. Function complexes in DNC systems.

Key:
1. Direct computer guidance of several numerically controlled work stations
2. Basic function
3. NC data
4. Distribution, archiving, actualizing, maintenance, safety, testing
5. Expansion function
6. Manipulation, programming
7. Data acquisition
8. Operating data, state data, progress control

These functions are carried out in DNC-CONCEMA through the TOBS 4200 operating system. In accordance with the functional classification in Figure 3, borrowing from [10], there should be assigned to the data flow the following interfaces:

i. S1--data transfer with the NCM,

ii. S2--communication with the data processing equipment,

iii. S3--functional complexes of manufacturing control.

In the TOBS 4200 the priorities of the interrupt treatment are correspondingly regulated. To secure reliable DNC functioning operations are carried out in the primary storage of the KRS 4201 in alternate buffer mode. The operating system and all applications programs are backed up against destruction by archiving in external storage with real time access. The TOBS resides in the primary storage during operation. In conjunction with the applications programs it makes possible an unrestricted basic function as well as the NC data manipulation of the expanded functions.

Data to be loaded into the alternate buffer are defined through interrupts at the S1, S2 and S3 interfaces. The reloading is organized by the operating system. Data transferred to data movement external to the computer are recorded in output registers and management files and remain reproducible up to the point of the subsequent data output. This yields a significant data backup which has proven its value particularly in error localization during the inauguration of the DNC-ZEMAG system. The DNC basic function of data distribution through the S1 interface is accomplished without commentary through interrupts by the machine operator or by the NCM calling for the data. It is generally connected with a syntax test carried out through the generating data bloc. Thus this form of data transmission is superior to information transmission depending upon paper and storage. The on-line information flow from the point of technical preparation through distribution to the NCM is fast, uncomplicated and reliable. Over and above this the DNC basic function, by means of the machine-selective alternate buffer in the principal storage, permits an unobstructed parallel supply to several NCM using only one NC program.

The DNC expansion function--NC data manipulation--presupposes the inclusion of properly standardized communication peripherals of the DNC computer or of the alphanumeric display ADP 2000. The dialogue is carried out through the S2 interface and in terms of priority is subordinated to the S1 interface. Syntax errors are suppressed by the generating data bloc. The mobile terminal ADP 2000 may be employed optionally in the programming office, at the DNC computer or directly at the NCM.

The expansion function--operating data acquisition--acts in conjunction with the basic function and the operating activities of the manufacturer at the DNC-Supplement (the DNC 520 operating monitor). This function yields the following protocols:

i. statistics of equipment utilization,

ii. manufacturing progress control.

The equipment statistics can be recorded in terms of shift, day, week and month. It contains utilization graphics established in terms of 27 specific positions.

The manufacturing progress control displays the sequence of contract manufacture in terms of schedule and includes a count of workpieces. The manufacturer's demand for a new NC program terminates the contract and leads to a protocolled target-actual comparison of workpieces and times. A teletype is

installed noncentrally in the equipment maintenance area and protocols any occurring breakdowns ultimately with the basic function so as to exclude erroneous information.

2.4. Operating Mode, Reliability and Risk

The DNC-ZEMAG system has been working for more than 3 years on three shifts. Pessimistic reliability predictions can be refuted convincingly. The prognoses of a breakdown of all NCM may indeed be accepted qualitatively but the statements are misleading and quantitatively the values are of a remarkably small order of magnitude (Table 1). Similar quantitative determinations of the high reliability of DNC systems in a comparable installation [12] underscore this fact. At the same time it must be borne in mind that during the period of analysis of the DNC-ZEMAG system organizational changeovers of the repair service caused one breakdown to last for 27 hours [10]. It is to be especially emphasized that by means of the BTR linkup it is possible to continue autonomous operation with punched tapes in the breakdown reserve without problems and with little delay. The reasons for the high reliability have to do with both hardware and software. In terms of hardware it is a consequence of the use classes and the backup quality measures of the technology employed:

i. the KRS 4201 which is air conditioned and centrally located in the shop has high availability parameters as a process control computer;

ii. the coupling element CNC 590 and the DNC-Supplement to the NCM are resistant to the rough shop climate through safety level IP 54;

iii. inductively shielded aboveground and underground conduits of the over 3.5-km-long information cable guarantees in conjunction with the help of an area electrical ground looped over the entire DNC configuration a transmission of information which is correct in terms of time and quality.

Table 1. Reliability of DNC Systems

Indicator	Unit	DNC-ZEMAG	DNC K&T
NC machines	Each	15	15
Operating time	Hours	3,139.60	4,368.00
Breakdown duration	Hours	46.30	19.00
Number of breakdowns	Each	14	25
Average breakdown duration	Hours	3.31	0.76
MTBF	Hours	217.70	173.90
Duration of availability	%	98.60	99.60

On the software side, the DNC-CONCEMA operating system possesses a self-diagnostic capability [13] for internal diagnosis of the computer system and for external diagnosis of the subsystems of the DNC configuration. With the diagnostic procedures of DNC-CONCEMA both internally and externally there is in effect a permanent process of diagnosis and depending upon the situation additional diagnostic programs can be loaded. Hence it is largely superfluous to switch off the DNC facility because of breakdowns. Essential importance also

attaches to cooperation between diagnosis and the expansion function--operating data acquisition--to secure increased objectivity in the breakdown statistics of the equipment.

The most frequently occurring causes of breakdown are:

i. short-term interruptions of the electrical power supply, e.g., through the action of electrical storms;

ii. blocking of information transfer between the DNC computers and individual NCM, because of ambiguity in information references relating to data transfer. This is a result of:

a) faulty operating at the NCM or at the DNC 520 monitor in the case of errors introduced at the computer,

b) short-term error displays emanating from the DNC computer and initiated by machine errors; these in turn give rise to blockage of data transfer in the computer,

c) general operating errors at the DNC 520 monitor and feedback effects from these acting on the alternative buffer in the primary storage;

iii. interrupted consistency between DNC computers and machine operators or between those computers and the NCM. These occur for various reasons.

As a rule these disturbances do not have significant consequences or produce damage. Diagnostic procedures and restarting software tend to assist the elimination of errors. These episodes are preponderantly attributable to subjective causes. With respect to the operation of the DNC-ZEMAG system, searching evaluations have resulted in drastic reductions of such disturbances.

It should be stated that for the fulfillment of its basic function and its expanded function a DNC system possesses a high level of reliability and may be used with confidence as a central starting point of an automation process extending throughout an entire shop.

3. Summary

Direct computer guidance of numerically controlled work stations is a substantial step toward flexible automation. It releases one from dependence upon written information transfer and it provides on-line information flows which are uncomplicated, reliable and fast. By means of it new vistas are opened up to machine intelligence and to the situation-dependent process adaptation which such machine intelligence requires. The reliability of DNC justifies the use of this type of cooperative information processing in the automation of minimal-labor manufacturing.

Glossary

AS	Interconnection control
BSM	Operating keyboard
DP	Facing machine
ESK	Real time control channel
FKrSRS	Milling machine with cross slide table
KRS	Small computer system
LAE	Logic output and input unit
LBL	Punched tape reader
LBS	Punched tape puncher
NCM	NC machine
SD	Serial printer
TOBS	Drum-oriented operating system

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8008
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GERMAN DEMOCRATIC REPUBLIC

NEW CNC SYSTEM DESCRIBED

East Berlin FERTIGUNGSTECHNIK UND BETRIEB in German Vol 34, No 11, 1984 pp 652-658

[Article by W. Herbst, engineer, and K. Schmiedgen, engineer, Berlin VEB "7 October" Machine Tool Combine, Karl-Marx-Stadt VEB Grinding Machine Works]

[Text] 0. Introduction

The trend toward the automation of machine tools, the development of CNC-controlled machine tools and the introduction of industrial robot technology and manipulatory technology are leading to ever higher demands upon the controls for these machines and this equipment.

After it became possible in 1971 to produce the complete central processing unit of a digital computer in the form of a highly integrated switching circuit ways were opened up in machine tool construction toward the performance of highly demanding tasks, with the aid of microelectronics, in the above-mentioned areas.

Companies developing control systems and manufacturing them have made use of this fascinating technology and have placed on the market a multitude of products specially designed to solve such problems for lathes, milling machines and drilling machines.

Grinding technology has also been brought to an increasing degree within the scope of this process of automation. Because of deficient knowledge hitherto of grinding technology on the part of the manufacturers of control systems and because of the specific nature of grinding technology there was little specialized equipment available on the market in the domain of control technology for this particular branch of industry. For this reason the Karl-Marx-Stadt VEB Grinding Machine Works has developed a microelectronic control system which is freely programmable and designed optimally for grinding machines.

1. Functional Content and Advantages of the Control System Specially Designed for Grinding Machines

Hitherto the conventional design of controls responded to an extension of the functional content of the machines, to the special wishes of clients or, for

example, to the employment of positioning controls using electrical rather than hydraulic drives, by steadily enlarging the outlay for hardware.

The use of programmable computer technology opens up possibilities which were not available using conventional technology. This is true particularly with respect to minimization of the number of structural components employed, the solution of complicated switching circuit problems, arithmetical computations, as well as the control and display of errors with the aid of a system of error diagnosis.

The newly developed PC control is optimally designed for use with grinding machines. In creating this design special emphasis has been given to the use of internationally proven and internationally interchangeable structural elements. Concentration of the control onto managing disks guarantees not only a small structural volume but also high functional efficiency, reliability and good machine servicing (Figure 1 [Photo not reproduced]).

The control system achieves for grinding machines and grinding automata

i. overall logical interconnection of machine functions,

ii. an electronic stepped switching network for the control of industrial robots and workpiece magazines,

iii. the control of two step drives including the positioning of these drives, the establishment of frequency, starting and braking processes and direction decision,

iv. the entire sequence of infeeding, controlled both by internal coincidences and also by measurement.

Thus it simultaneously solves real CNC problems.

Additional control functions are

i. the functional course of central lubrication,

ii. both after a specific preselectable time and also after a preselected number of workpieces,

iii. the complete adjustment program and

iv. the control of auxiliary functions, e.g., automatic centering--drilling--lubrication.

All technological values such as:

i. back-travel of the grinding headstock,

ii. paths for roughing/finishing/fine finishing,

iii. sparking out time,

iv. compensatory quantity,

v. adjustment interval,

vi. lubrication interval, etc.,

can be input through the keyboard.

The feed velocities can be preselected at 14-pole stepped switches and if necessary can be changed during processing. Special services offered to the clients are

i. automatic workpiece counting,

ii. time interval measurement with display of basic time,

a) assistance time,

b) adjustment time,

iii. and the individual times for

a) sparking out,

b) roughing,

c) finishing and

d) fine finishing.

The technological values input through the keyboard and the position of the workpiece feed are retained even during emergency shutdown, electrical power supply failure or a shutdown at the main switch. This is accomplished by the use of CMOS-RAM's which are battery-supported.

The functions which have been described are achieved at the lowest level of structural expansion.

It is always possible to expand this control system thanks to its modular design. For the control of the functions which have been named only 8 kbytes out of a total storage content of 14 kbytes is being used at the present time (Figure 2 [Photo not reproduced]).

An intelligent maintenance of software makes it possible to reconstruct the program for the client even after several years, or when necessary to modify the program or to make replacement EPROM's available. The client can himself make changes at the machine in the Boolean program such as changes in the sequencing of functions, time sequences and the like. To this end there has been developed (see Figure 1) a transportable programming device which can be connected to the control module through the plug connection bus.

An EPROM programming device integrated into the programming device permits burning in new EPROM's consistent with the modified, tested program.

The small dimensions and the low mass of this programming device as well as the employment of the data keyboard and of the display for programming the control process are especially advantageous for the convenience of servicing operations both domestically and abroad.

By using microelectronic controls for grinding machines the clients can also solve complicated technological problems in a short period of time. At the same time the client is supplied with machines which guarantee high operating comfort and a high level of functional efficiency.

2. Practical Use Experience and Advantage to the User

The first machine model to be so equipped was the model SASE 200/06-PC plain grinding and plunge-cut grinding machine which was fitted out with the new control. Its first industrial use was on the fully automated machine shown in Figure 3 [Photo not reproduced]. The aim of every new or further development is in the last analysis the achievement of higher productivity and workpiece quality over as long a period of use of the equipment as possible and with a high level of utility for the entire machine. This has been attained with the machine when equipped with the new control system. It has been attained to the fullest extent thus far in industrial use for 2 years in double and triple shifts.

The SASE 200/06-PC is a high-performance production grinding machine on which it is possible to simultaneously process several cylindrical or conical close-fitting surfaces and several planar sides (Figure 4 [Photo not reproduced]).

Its principal area of use is in large-batch production and mass production, in other words especially in the automobile and automobile accessory industry, in electrical motor construction and diesel engine construction and in related branches of industry. In addition to its being equipped with the modern type of control the machine also presents a high level of machine construction technology and industrial processing technology as prerequisites for the treatment of a high level of utility to the user. Essential features here are:

i. the employment of high grinding velocities up to 60 m/sec in conjunction with a highly efficient cooling system and large grinding motor outputs up to 22 kw in order to obtain low machine times t_{Gm},

ii. variable oblique angular settings of the grinding body,

iii. large grinding body diameter (750 mm) and large grinding body breadths up to 200 mm,

iv. electromechanical feeding system of the grinding body via a step motor and worm drive within a tool-advance velocity range from 0.006 to 12 mm/min, maintained with good constancy,

v. the use of precise and productive adjustment processes with fully automatic cycle (duplication adjustment or adjustment with diamond roller),

vi. high level of automation through the use of integrated industrial robots and various types of workpiece magazines,

vii. automation of the measurement process using electronic measurement controls and axial positioning controls as well as automation of the auxiliary processes (e.g., workpiece chucking, angular positioning of the workpiece, lubrication of the machine and centering--drilling of the workpiece), Figure 5 [Figure not reproduced].

An extensive assortment of special equipment makes possible in any given case the most favorable machine equipment corresponding to the particular processing task and to the requirements of the client. Optimization of the automated function sequencing, which the PC control makes possible, guarantees low machine assistance times t_{Hm}. These times, depending upon the number of functions required, range from 8 to 12 seconds.

We shall present two jobs as examples documenting the capabilities of the machine and of the control system.

The trunnion and planar side of the crank-pin disk shown in Figure 6 [Figure not reproduced], because of the required high precision of the trunnion (straightness of the generatrix = 1 μm/16 mm, circularity error = 1 μm), had previously been ground on an oblique plunge-cut grinding machine with hydraulic feed and a straight plunge-cut grinding machine (fine working of the trunnion with an offset of 0.03 μm). On the SASE 200/06-PC this workpiece is now produced fully automatically in one operation with the required efficiency and precision. Up to now about 500,000 workpieces have been ground with constant quality and productivity in the case of this particular job has increased to 200 percent of the productivity under the old technology.

The reliability V_{DN} of the machine including PF control was 97 percent. Process-specific peculiar problems were well resolved using the PC control. We refer, for example, to an axial rebound of the workpiece spindle sleeve before the start of fine grinding. This is in order to avoid effects upon the roundness of the trunnion produced by the differing drifting forces arising during grinding of the repeatedly interrupted planar side.

During the grinding processing of the illustrative job shown in Figure 7 [Figure not reproduced] the trunnion diameter and planar side are ground together during the second operation in automatic sequence and with measurement-determined control. During this operation the feed of the grinding headstock and of the workpiece sleeve spindle (axial feed) take place separately by means of separate step motors. This feed is carried out productively and precisely by means of the microprocessor-controlled SASE 200/06-PC.

3. Summary

In order to be able to exploit the advantages of modern freely programmable microprocessor controls for the special task of controlling plain grinding machines, the Karl-Marx-Stadt VEB Grinding Machine Works has developed its own optimized control system. Its first use was with the fully automated oblique plunge-cut grinding machine SASE 200/06-PC.

The knowledge gained during testing of this PC control and its multishift industrial use during 2 years confirm its advantages for machine manufacturers and users and this knowledge has formed the foundation for the introduction of this control system in connection with all models of production-type plain grinding machines manufactured by the Karl-Marx-Stadt VEB Grinding Machine Works.

8008
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GERMAN DEMOCRATIG REPUBLIC

BRIEFS

ALUMINUM FOIL PRODUCTION ADVANCES -- Brandenburg (adn/NZ). This year marked important progress in the development of the refining metallurgy for the 130,000 metallurgists in the GDR. New metallurgical methods were introduced into production and others expanded. This includes the start of operation of the modern converter steel works in Eisenhuettenstadt. - On the "Day of the Metallurgist" last weekend in Brandenburg, State Secretary in the Ministery for Ore Mining, Metallurgy and Potassium, Dr. Klaus Blessing, honored the work of our metallurgists. He pointed out that at present more than three fourths of all rolled steel and 90.7 per cent of the manufacture of products in the nonferrous metallurgy are refined. For example, a new technology in the Mansfield combine makes it possible to reduce the thickness of the aluminum foil made in Merseburg from 22.3 to 18.2 micrometers. The savings in material made it possible to produce an additional 3,800 m^2 of foil. The formal address referred to the great contributions by the metallurgists of the GDR in the past three and one-half decades. Both steel- and nonferrous metal production rose between 1949 and 1984 fourteen times. Rolled-steel production grew eleven-fold. In a statement of intent to the General Secretary of the SED, Erich Honecker, the task is accepted to stay below the anticipated production consumption, especially in energy carriers, and to make available among others 75,000 tons rolled steel, 13,000 tons potash, 800 tons nonferrous metals from domestic primary and secondary raw materials to the national economy by year's end, going beyond the plan tasks. [Text] [East Berlin NATIONAL ZEITUNG in German 19 Nov 84 p 2] 9243

HORIZONTAL BORING, MILLING MACHINE -- The horizontal boring and milling machine BFT130 is a machine with a medium degree of automation. The continuous speed was introduced and the maximum speed of the cutter bar was increased with raised drive power to 1,000 rpm. The product is equipped with the numerical path control TNC145 from the Heidenhain company. Controlled are transverse table motion, altitude motion of the headstock and longitudinal table motion. In conjunction with a 4 . 90° position setting of the work table, a four-sided travel operation is possible. In addition, the machine can be used for "circular milling", i.e. large holes are not produced with cutterheads or cross slides, but by a cutter whose center (drilling spindle) describes an appropriate circular path. The program for working is put in by the operator in clear-code dialog. The program established in the dialog can be repeated at any time or stored on a data input medium. The control processes desired positions, advance speeds, spindle speeds, tool data and additional functions. Permanently stored subprograms for deep-hole boring, tapping, slot cutting and pocket cutting are additional advantages in the product. The NC technology is also used for defect diagnosis, With its own checking programs, the control tests the operation of a machine and records defective structural groups. This helps to localize defects so that the idling times caused by breakdowns can be reduced considerably. (Manufacturer: VEB Werkzeugmaschinenfabrik Union Gera) Za. [Text] [East Berlin FERTIGUNGSTECHNIK UND BETRIEB in German Vol 34 No 10, 1984 p 631] 9243

NEW CNC BORING MILL -- The double-column coordinate boring and cutting machine BKOZ 900 . 1,400/6NC3, manufactured by VEB MIKROMAT, Dresden, represents a further evolution within the framework of the proven two-column coordinate boring and cutting machine construction series. It unites the accuracy of a coordinate boring machine with the productivity of a production machine and therefore allows, especially in the main production of the metal working industry, the economic programmed working of metal parts with high accuracy requirements in the micrometer sector. Due to the chipping power of 4.6 kW on the main spindle and the high degree of automation, attributable chiefly to the microprocessor control CNC-H 646, use of this machine is particularly economic in small- and medium-series production and appropriate for repetitive parts and repetitive series. An additional advantage lies in the manufacture of parts which exhibit many similar working elements. In molding- and gauge engineering, profiles can be cut on the basis of mathematically defined curves. The operators need not execute frequent tool changes, multiple-machine operation is possible. The working processes boring, drilling up, facing, counter boring, backward counter boring, milling, cutting, measuring and threading with compensating feed can be executed to advantage with the help of the microprocessor control. It allows direct and optimum adjustment of the feed- and cutting rates. The process paths amount in the X axis to 1,120 mm and in the Y axis to 710 mm. The greatest boring diameter for steel parts amounts to 50 mm, and the largest cutting diameter to 250 mm. The base surface is 4,065 mm . 4,290 mm, and the connected load is 35 kW. Za. [Text] [East Berlin FERTIGUNGSTECHNIK UND BETRIEB in German Vol 34 No 9, 1984 p 561] 9243

ROBOTICS APPLICATION STATISTICS CITED -- The number of industrial robots used at present in the Karl-Marx-Stadt region commands respect: There are 7,212, which means roughly one out of five of the 35,000 robotics already available in our republic can be found in this industrial center. An imposing treasure of experience when using this highly productive technology already exists today in 304 organizations of the area, from the metalworking industry over companies of the light-metal and textile industry to the Vogtland's construction of musical instruments. If there were 766 registrations of users in the area in 1977, this number had been increased in 1983 by 1,556 new industrial robots, which means that the pace of introduction had already more than doubled. A clear demonstration of progress made in the realization of the economic strategy decided upon at the Tenth Party Day of the SED, which gave special priority to robotics technology, in conjunction with the rationalization and automation of related technological processes. As do micro-electronics, robotics technology belongs to those fields of structure-policy strong points, to which special attention had been devoted for some time when gearing the national economy to the requirements of the eighties. Micro-electronics and robotics technology have a considerable effect on the development of productive forces. By bringing their productive effects to increasingly greater importance, we create essential provisions for an unbroken continuation of the policy of the main task under conditions of the eighties. [Excerpt] [East Berlin NEUES DEUTSCHLAND in German 31 Oct 84 p 3] 9243

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HUNGARY

PARTICIPATION, INSTRUMENTATION OF SOVIET VEGA PROJECT

Budapest MAGYAR ELEKTRONIKA in Hungarian No 1, 1984 pp 94-95

[Article in "Interfaces" column by Tamas Hetenyi: "The VEGA Program"]

[Text] Although mankind has been watching comets for several thousand years we know relatively little about them. In general our information is based on indirect observations. Even the largest terrestrial telescopes are not capable of seeing through the comet's coma, so we have only hypotheses about what is inside the coma. Even today imagination plays a great role, in addition to the few facts available. Thus the basic goal of the various Haley programs is to provide precise observations of the internal regions of the comet comas, thus making possible a better understanding of the origin of comets--and in a broader sense of the solar system.

The Soviet Union has organized one of the Haley programs directed at achieving the above scientific goals. Scientists and engineers of a number of countries of the world are participating in the vast international program. The work is being coordinated by the Interkozmos Council of the Academy of Sciences of the Soviet Union. The most important participants are the French (CNES) and Hungarian (Hungarian Interkozmos Council) space research organizations. Significant roles have been undertaken by the Interkozmos Councils of Bulgaria. Czechoslovakia, the GDR and Poland, by the Max Plank research institute (FRG) and the Austrian Academy of Sciences.

An International Scientific and Technical Committee (the Russian abbreviation is MNTK) has been created to guide the VEGA program. It offers assistance to the leaders of the program in deciding the following questions:

--priority of scientific experiments,
--organizational work to carry out the experiments,
--distribution of the available weight, performance and telemetry capacity,
--selecting optimal operations program,
--organizing data processing,
--approving and modifying the pay load.

The MNTK reviews the work of the technical guiding personnel, directs operations prior to start and decides legal questions of publications and cooperation with other programs.

The chief of the MNTK, and also director of the program, is Academician R. Z. Sagdyeyev. The participating countries appoint one or more persons as members, depending on the size of their participation.

The technical director of the program (V. G. Perminov) and the French (J. Ruvanot) and Hungarian (L. Szabo) technical leaders coordinate the development of the pay load.

The scientific pay load of the VEGA probe consists of 12 instruments, with a total weight of 103.9 kilograms. Three of the scientific devices will be placed on the mobile platform designated ASP-G. The total weight of these is 25 kilograms. The on-board data collector (BLISI) and command receiver (BUNA) are also counted in the scientific pay load. The equipment directed at the comet nucleus consists of a television system (TVS), an infrared (IKS) and a three channel (TKS) spectrometer. Nine devices will be placed in the body of the probe: the dust mass spectrometer (PUMA), the acoustic collision dust counter (SP-2), the collision plasma cloud counter (SP-1), the neutral gas mass spectrometer (ING), the plasma analysis system (PLAZMAG), the particle energy telescope system (TUNDE), the high (APV-V) and low (APV-N) frequency plasma wave analyzer and the magnetometer (MISCHA).

The Hungarian experts are interested in four themes in the program being conducted with great effort. The BLISI (under the guidance of Tamas Hetenyi of the Budapast Technical University), the TVS (under the guidance of Sandor Szalay of the KFKI--Central Physics Research Institute), the TUNDE (under the direction of Istvan T.-Szuts of the KFKI) and the PLAZMAG (under the guidance of Istvan Apathy of the KFKI) are being prepared in Hungary. The leader of the Hungarian program is Karoly Szego (KFKI) and the technical director is Laszlo Szabo (KFKI). (We will return to a detailed description of the program.)

8984
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HUNGARY

TELEMETRY SYSTEMS OF INTERKOSMOS SATELLITES

Budapest MAGYAR ELEKTRONIKA in Hungarian No 1, 1984 p 95

[Article in "Interface" column by Tamas Hetenyi: "Telemetry Systems of the INTERKOZMOS Satellites"]

[Text] The INTERKOZMOS space research organization of the socialist countries has been conducting regular scientific research of the region about the Earth since the middle 1960's. Standardizing the telemetry systems serving to collect and pass on the data of the scientific devices on the satellites has been one of the aspirations of the organization from the beginning.

The first INTERKOZMOS uniform telemetry system (ETMS-1) was developed at the beginning of the 1970's, organized by the GDR. Czechoslovakia, Poland, Hungary and the Soviet Union participated in the work. The Hungarians were represented by a space research group working in the microwave signal technology faculty of the Budapest Technical University, with the development of an on-board analog-digital converter and switching power unit and by participating in the development of checking measurements for the system.

The ETMS-1 system served primarily to collect on-board analog signals and it was used successfully on satellites IK-15, IK-17, IK-18 and IK-19.

In time the development of satellite on-board systems posed significant demands for the telemetry systems too. The most important of these are the following:

--The telemetry system must be prepared primarily to collect digital information.

--It is advantageous if the available telemetry capacity can be distributed among the experiments according to the momentary needs, i.e., if it is programmable.

--The bit speed determines the capacity of telemetry itself at a given moment. A need to change the bit speed frequently arises, especially in those satellites which go far from Earth in an extended elliptical orbit. Transmitter power on satellites is usually limited, so due to the great

phase attenuation data transmission of suitable quality can be obtained for a satellite far from Earth only by decreasing the bit speed.

--Users need to maintain operational contact with on-board experiments.

--In modern systems the telemetry unit is capable of two-way communication, that is it has a receiver in addition to a data transmitter and experimenters on Earth can directly control their on-board scientific equipment via the receiver.

Hungary proposed in 1979 the development of a telemetry system satisfying the above requirements within the INTERKOZMOS organization. The member countries accepted this proposal and the development is nearing completion. Czechoslovakia joined in the concrete developmental work with the development of an on-board receiver and a 136 MHz on-board transmitter and with participation in the development of an earth control unit for the telemetry system. The Space Research Group of the microwave signal technology faculty of the Budapest Technical University is developing the other units of the telemetry system.

The ETMS-2 system has 14 serial digital channels and 16 analog channels in the direction of the experiments. The serial digital connection is bidirectional. The experiments send the measurement results toward the telemetry while the telemetry system sends the operational parameters needed for the experiments in the other direction.

The so-called structure memory in both the analog and digital data collector determines the telemetry capacity of the experiments--that is, the amount of data queried from the individual experiments in one block of time. These can store eight different telemetry structures simultaneously; four of these are fixed (programmed in before the satellite leaves Earth) while four can be rewritten during flight. Earth command or on-board automatics can select from among the eight possible telemetry structures.

The data speed can be 10, 20, 40 or 80 Kbit/s according to Earth command or on-board automatic selection. One can choose between two types of line modulation (split-phase or delayed modulation) at the serial output.

The central unit of the equipment is a microcomputer based on an NSC-800 microprocessor. The so-called command receiver is interfaced with the microcomputer; information from Earth stations can be put into the memory of the microcomputer through this receiver.

Even the microcomputer program can be changed via the command receiver. In this way the on-board services can be constantly changed and expanded even during flight on the basis of experiences gained during the flight of the satellite.

Development is under way at the microwave signal technology faculty of the Budapest Technical University of a special programming language, a version of the FORTH language adapted for this purpose, to optimize communication with the computer and help make the writing of programs more effective.
8984
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HUNGARY

MARKING CHANGES ON SOVIET IC'S EXPLAINED

Budapest MAGYAR ELEKTRONIKA in Hungarian No 1, 1984 p 89

[Article: "EMO (Elektromodul electronic parts cooperative) News--Type Designation of Soviet Integrated Circuits"]

[Text] The letters and numbers in the designation system for integrated circuits manufactured in the Soviet Union have definite meanings. Knowing this one can a proximately determine from the type designation the function of the IC.

The possibility of listing LSI-VLSI circuit versions in the designation system used since July 1974 proved unsatisfactory, so the designation system was revised. This designation system can be found in branch standard OSZT 11 o73.915-80. Thus the customer may get circuits with the same function with two different designations depending on the time of manufacture.

The change in designation could cause confusion or misunderstanding. For this reason the EMO requests that the responsible organization of enterprises (technical development, material acquisition and standards sections, foreign commodity purchasing, etc) take note of this.

In what follows we will describe the modified designation system and indicate the change compared to the earlier one.

The structure of the type designation system remains. The digits, the meaning of some of which is given while others have an administrative character, have not changed either.

We present the original Cyrillic letters in a Latin transliteration. We illustrate the composition of an entire type designator with the following diagram:

	1st elem.	2nd elem.	3rd elem.	4th elem.	
(E) K R	1	5 5	L A	3	(A) P
initial letters	series		circuit version		supplementary designation
	basic designation				

In the diagram (arbitrarily) we have called the elements detailed in the original description which basically define the circuit the "basic designation," and we have called the elements designating applications conditions the "initial" indicator. Finally, in what follows, we will call elements within the type designation referring to different parameters or encapsulation the "supplementary" designation.

Meaning of the Initial Letters

The type of designator also refers to the climate and physical (mechanical) use possibilities. If there is no letter prefix and the type designator begins with a three member number group, this means a type designated for hard physical use, with extended temperature limits (for example, from minus 60 to plus 125 degrees Celsius). The numerical values of the classification prescriptions vary; these are set forth by the documentation valid for the series.

The letter K indicates a version to be used in consumer electronic equipment, where the physical demands are less strict; the operational temperature range is narrower also, but can have different values for different series. Here also the documentation published for the series is the guide.

KM means that the entire series is distributed in ceramic capsules. This corresponds to greater demand prescriptions.

KR also means a use category set forth in the test prescriptions pertaining to the series.

Types beginning with the letter E are made for export. It is well known that the standards of the Soviet Union prescribe a distance of 2.5 mm between feet, as compared to the 2.54 mm foot distance usual in other countries. Deliveries with this foot division also are made possible as a result of the nature of one manufacturing line (the EK561 line). It must be emphasized that this is an exceptional property; there is no way to submit orders combined with the letter E for just any series.

B means an unencapsulated integrated circuit.

Explanation of Basic Designators

First element--a single digit number indicating the classification of the circuit into a structural technological group. All integrated circuits manufactured in series can be divided into three groups on the basis of their structural technological character. These are provided with the following designations:

1, 5, 6 and 7 are integrated circuits based on a semiconductor (the unencapsulated versions receive the 7 designation);

2, 4, and 8 are hybrid integrated circuits;

3 means other (layer, vacuum, ceramic) circuits.

Second element--a two (00-99) or three (000-999) digit number indicating the developmental serial number of the integrated circuit version.

The first two elements (a three or four digit number) are the indicator of the circuit series.

Third element--two letters which correspond to circuit subgroup and circuit version classified according to function.

Fourth element--the developmental serial number of the integrated circuit version can consist of one or more digits.

Explanation of Supplementary Designators

The spread of the electric parameters of the given version (due to technological causes) can be designated with a letter. The technical documentation issued for the product contains the value of the differences. (For example, the K155LA1A differs from the K155LA1B.)

The letter at the end of the type designator in a few series defines the capsule. For example, the letter P indicates a plastic capsule, the letter M indicates a ceramic capsule.

Examples of Designations

1. Type designator K1801VE1: semiconductor based, 801 series development serial number, microcomputer, with 1st developmental serial number.

2. Type designator 133LA1: semiconductor based, 133 series developmental serial number, AND-NOT logic element, with 1st developmental serial number.

A detailed tabular summary appeared in issue No 1, 1983, of the Elektromodul Bulletin.

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HUNGARY

ES 1056 SYSTEM, LATEST VERSION OF ROBOTRON 1055

Budapest SZAMITASTECHNIKA in Hungarian No 12, Dec 84 p 8

[Text] With creation of the Es 1056 the development collective of the Robotron Kombinat has completed the project aimed at perfecting the ES 1055 in the interest of improving the efficiency of use and manufacture. The new operating system and speed increasing solutions in the central unit increase the performance capacity of the system. Advances from the viewpoint of material and energy savings are characterized by the fact that they used 43 percent less copper, 30 percent less aluminum and 90 percent less dynamo sheet for manufacture. The consumption of the system was reduced to half. The ES 7069 M management and service processor substantially improves the man-machine link in the course of both operation and maintenance.

The ES 2156 new central unit consists of two cabinets, occupies a space of 1.8 square meters and draws a current of 4 kVA. Its operating speed is 505,000 operations per second and the cycle time is 380 ns. The capacity of operational memory is 2 or 4 M bytes. The maximum number of channels is five (two of which are block multiplex channels). The speed of data exchange on the block multiplex channel is 1.7 M bytes per second (with a 1 byte interface), and 40 K bytes per second on the byte multiplex channel (in multiplex mode). The newly developed OS-7ES operating system consists of three units: the SVM 3.0 version and the BPS 7.0 and SVS 7.0 editions. The SVM 3.0 replaces the previous SVM/ES and is upwardly compatible with the SVM 1 and 2 versions, but is functionally expanded. In addition it makes possible more efficient job performance on virtual machines. Special microprograms built into the central unit support the operation of SVM also. The BPS realizes batched processing in a virtual environment, while the SVS was made for both real and virtual batched runs.

A number of supplements and performance-increasing solutions were prepared for the SVS 7.0. The OS-7ES operating system contains a complete independently generated sorting-selecting program, which can also be run with the BPS and SVS. It can handle the PL/I, COBOL, FORTRAN and PASCAL languages with the aid of its own interpreting, optimizing and test programs, which are compatible with one another. The OS-7ES operating system can be run on series 2 ESR machines in addition to the ES 1056.

8984
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ROMANIA

ACHIEVEMENTS, FUTURE OF ROMANIAN COMPUTER INDUSTRY

Budapest SZAMITASTECHNIKA in Hungarian No 12, Dec 84 p 6

[Article by George Albut, secretary of the embassy of the Romanian Socialist Republic: "Achievements and Future of the Romanian Computer Industry"]

[Text] The development of the computer industry is closely interdependent with two programs adopted by the party--that of 1967 which laid the foundations for the creation of the Romanian computer industry and defined the general system conception for application of computer technologies, and that of 1971-1972 which defined the chief lines for broad information flow within society, closely connected with the perfection of the socio-economic information system and based on the development of national computer manufacture.

The creation of the Romanian computer industry in 1967-1968 and its further development are part of a swift and many-sided growth of Romanian industry, in accordance with the growth of the technical-scientific revolution and of efficiency and quality, and are one method for reaching the strategic goal aimed at increasing the productivity of work: "... we want to achieve all this by virtue of a better organization of production and work, of production processes, by introducing mechanization and automation and modern methods of production guidance," said President N. Ceausescu, first secretary of the Romanian Communist Party, at the plenary session of the Central Committee of the Romanian Communist Party in June 1983.

The Romanian computer industry, originally based on manufacturing licenses, now relies on its own ideas and is capable of supplying the necessary products to approximately 25,000 experts working at nearly 1,500 information units and of satisfying socialist and capitalist export requirements. The Romanian computer industry reached a new qualitative level in the course of the last 5-year plan.

Table 1. The dynamic growth of the computer technology sub-branch in the plan period can be characterized by the following data:

Index	Unit of measurement	1975	1980
Value of computer technology production within social production	percent	0.21	0.29
Dynamic of the value of computer technology products	percent	100	204
Electronic computer manufacture	(units equivalent to 128 K bytes)	37	216

Source: 1981 statistical yearbook for Romania; the first line contains calculated values.

The present 5-year plan preserves this growth character. All this is based on a document of the 12th congress of the Romanian Communist Party which, among other things, sets forth the following fundamental line:

--"...development of a new minicomputer, equipment for research and data input, the necessary software for micro and minicomputers, and of process control computers....

--"...optimal organization and operation of a uniform guidance system for socioeconomic processes based on broad use of cybernetic methods and modern computerized techniques....

--"...working out the optimal solutions necessary for development and operation of a national information system, including a computerized data transmission network which will result in significant changes in the guidance of socioeconomic life...."

The policy realized by the Romanian Communist Party in the area of computer technology can be characterized as a modern system conception for computer manufacture and use. It is directed primarily at increasing the productivity of work, at integration of branch development, at increasing quality and efficiency and at furthering international cooperation.

Organizational Structure and Profile of the Computer Industry

The Electronic Computer Manufacturing Enterprise (ICE) in Bucharest plays a central role in computer manufacture. It manufactures and delivers computers, minicomputers and microcomputer configurations in cooperation with a peripheral manufacturing enterprise (IEP) in Bucharest, with an enterprise (FMCCE) in Temesvar [Timisoara] manufacturing stores and electronic computer parts and with a joint Romanian-American undertaking (Romcontroldata--RCD) in Bucharest. Maintenance of computers and equipment is provided by the Computer and Professional Electronic Equipment Maintenance and Repair Enterprise (IIRUC), which has offices in every larger city. Scientific research and technological development are

performed by the Computer Technology Research Institute, which is also responsible for development and maintenance of system software program products, and by the research and development departments of the enterprises mentioned. These units belong to the Electronics and Computer Technology Industrial Center (CIETC).

In realizing computerized process control systems and remote processing systems the Bucharest Automatics Enterprise is active in the area of automatic control of machine tools in technological lines and of robots, the Automatic Elements Factory (FEA) in Bucharest in the area of microcomputer technology process checking and control systems, and the Automatic Assemblies Factory in Kolozsvar [Cluj] in the area of modems and intelligent terminals. These units belong to the Electronics, Telecommunication and Automation Industry Center and to the Automation Research and Planning Institute (IPA).

The computer industry cooperates closely with the Guidance and Informatics Center Institute (ICI), which coordinates at the national level activity connected with development and realization of applications program products, and with high level institutions with which they have developed a number of integrated cooperation programs.

In the present five year plan period Romanian industry has been able to offer computer users the following categories of products at the world level:

--data collection (primary processing) and transforming equipment,

--equipment operating in the batched and conversational mode,

--microcomputer systems controlling technological processes,

--data transmission equipment,

--micro and minicomputer systems,

--system programs (operating systems),

--applications programs (for example, for computerized design in the conversational mode),

--systems realized on the basis of special consumer requirements, and

--auxiliary equipment (voltage/frequency controlled power units, air conditioning units, automatic checking and danger indicating units).

Developmental Principles for Computer Manufacture

The organizational structure and development of national computer manufacture were based and are based on the following principles:

a. Ensuring horizontal and vertical integration.

The basic principle of horizontal integration involves achieving a minimal but effective product range in applications systems, satisfying the basic requirements of socio-economic units and modernization of this under the conditions of accelerated technical progress. For example, a complete renewal of computer manufacture was completed in 1982. Within the frameworks of their own research they are planning to develop only a single medium-large capacity computer type with virtual storage suitable for remote processing; they will use multiprocessor or computer network solutions in larger organizations and applications areas.

Commercial and financial data collection terminals are being developed.

The goal of vertical integration is development of the necessary hardware-software assortments, blocks, modules and elements. As the experiences of other countries also prove, this integration is limited, and it presumes the importation from socialist countries of certain peripheral units and high level microelectronic parts (microprocessors, large capacity semiconductor stores).

b. Manufacture of the testing tools needed for manufacture and operation (including production quality control).

In this connection we might mention the automatic data transmission control equipment and minicomputerized quality control equipment in series manufacture and the manufacture in small quantitites of nuclear power plant automatic control systems.

c. The conditions needed to achieve integrated production:

--central attention turned to research and development (in the present and next five year plans production based on our own research and development will exceed 90 percent);

--aiding mutually advantageous international cooperation within the framework of foreign trade conducted with socialist and other countries (the Felix C-512/1024 electronic computer, the Independent 100, 102F, and the Coral 4011, 4021 and 4030 minicomputers, the M18 and M118 microcomputers, the FC96, 128 accounting electronic machines, the HELIOS operating system, the MINOS and AMS operating systems for minicomputers and the program products needed for conversational design of printed circuits). All these represent achievements of Romanian computer technology research which are known in a number of countries;

--the cooperative manufacture conducted with the U.S. firm Control Data Corporation (through the Romanian-American Romcontroldata Association).

d. Ensuring the technical world level, including following the trends of development.

In 1984, for example, they began series manufacture of the first Romanian microcomputer and the first Romanian home microcomputer, manufacture of terminals, primarily graphic terminals, and expanded equipment-oriented to geometric data processing.

e. Use of modern methods (computer aided conversational designing, structured programming, etc).

The Romanian Socialist Republic contributes actively to the activities of the Computer Technology Intergovernment Committee and continually participates in hardware and software projects.

Of the international results achieved, the following examples might be mentioned:

--the I-100 minicomputer, winner of a gold medal at the 1979 international exhibit in Moscow,

--the I-102F minicomputer,

--the M18 microcomputer,

--the ECAROM micro system for process control,

--a floppy disk data collection terminal (FDF),

--the Telerom-P intelligent terminal,

--telephone line modems,

--optical fiber modems,

--semiconductor store blocks,

--operating systems for minicomputers (AMS, MINOS),

--program products for process control, remote data processing and other general applications areas.

Romania also coordinates development of operating systems for the SZM-2 microcomputer.

As part of the international cooperation with socialist countries on the basis of the principle of mutual advantages Romania is interested in a number of products:

--large and medium large capacity computers (Soviet Union, GDR),

--industrial data collection equipment (GDR),

--microprocessors, semiconductor stores and other VLSI circuits (Soviet Union, GDR),

--external stores, disk and tape units (Bulgaria, GDR),

--floppy disk drives (Hungary),

--graphics machines (Czechoslovakia),

--line printers (Poland),

--magnetic data carriers (Bulgaria, GDR).

We must note that the participation of the Romanian Socialist Republic in the computer technology foreign trade of the socialist countries, of the CEMA countries, is still low.

Chief Developmental Lines of the Romanian Computer Industry

In addition to the present chief general developmental lines we might mention the following:

a. Developing a uniform technical conception for computer use which will make possible the attaining of maximal efficiency within the socialist economy.

Surveys have shown that introduction and development of computer use at an accelerated pace at every level and in every area (especially in industry) is very important and that the general spread of shared information and teleinformatics solutions is an absolute requirement.

b. Standardization activity conducted on the basis of the above mentioned uniform conception, keeping in mind an increase in series size, a decrease in manufacturing costs, an increase in the magnitude of manufacturing specialization, a reduction in the time for realizing systems developed by a user, strict adherence to international standards and, consequently, aiding computer technology export.

c. Developing a program product industry which adapts without problems to users not experienced in computer technology; there is a need to solve technical and legal protection problems for program products and to develop correct methods for determining prices.

d. Developing services for external and internal users in the areas of instruction, documentation, product maintenance and mutual exchange of information.

e. A constant increase in the technical and technological level of Romanian computer technology products, including development of international technical-scientific cooperation, with special regard to the approaching appearance of fifth generation electronic computers.

Romanian Computer Technology Products

a. Data Collection and Pre-Processing Equipment

--Accounting and bookkeeping equipment: FC64/96/128 with 15 digits plus sign, 128 registers, electric writeout and input and output on punch tape and/or cassette; FC1000 electronic accounting/bookkeeping system with 1,000 registers and CRT display; MFC1000 microcomputer with 1-4 video terminals, external storage on floppy disk, and interface for telecommunications lines;

--AECC electronic cash-register family;

--Microsystems to check access and collect production data, with punch cards (TPM, TCDM) or line code (SECOL, SCUP);

--Magnetic tape converter for batched mode computer centers (SIDM with special posts; TDF/EPD/SIV with display terminals);

--Microsystem for text processing (SEPT);

--Portable terminal for data collection, TPCD (forwards stored data to an electronic computer via a data transmission system).

b. Peripheral Equipment

--Video terminal family for querying and graphic DAF 2010 for synchronous/asynchronous transmission; DAF 2012, DAT 2015 and UDT 40 for asynchronous transmission, DAF 2020 and Diagram 2030 graphic and Telerom-P intelligent terminals, etc.

--RCE 9228 card reader, 300-800 CP min.;

--Line printer (parallel RCD 9380/900--1,130 lines/min.), RCD 9334 matrix and ISM 150/50 char./s., CP100 thermal printer;

--Magnetic disk storage units; RCD 9742 (50 M bytes), RCD 9747 (60 M bytes);

--Magnetic tape units; UBM75 (1,600 bpi, 75 ips);

--Floppy disk storage units; UDF100 (500 K bytes), UDF 101 (1 M byte);

--Magnetic cassette tape storage units; UCM 101;

--Punch tape reader; LB 50 (50 Char./s.);

--Graphic output units; MD 10 (40 x 28.7) cm graphic machine, ICT800 drum graphic machines.

c. Microsystem Families for Interface and Control of Technological Processes

--Modular Escarom, Spot, Sevrom, special equipment for optimal control of aluminum electrolysis.

d. Data Transmission Equipment

--Modems for telephone lines:

Telerom 3MO (300 bit/s),
Telerom 3MI (600/1,200 bit/s),
Telerom 3M2 (1,200/2,400 bit/s),
Telerom 3M3 (4,800 bit/s),
Telerom M5 (600--1,200 bit/s),
Telerom M64 (64 K bits/s);

--Modems for fiber optic transmission; Fellas 2500 (0-4,800 bit/s asynchronous, 2,400-19,200 bit/s synchronous), Fellas 2505 (max. 19,200 bit/s);

--Multiplex terminal 3V1 (makes possible connection of maximum of 9 query terminals or other slow peripherals);

--Telecommunications lines for multiple path connection (multiplexer) MUX 420, for maximum of 8 terminals.

e. Computer Units

--Microcomputer type: M18/M118/CUB01, with maximum 64 K bytes internal memory; M216 with maximum 1 M byte internal memory; M18 as industrial cabinet and others as desk equipment with keyboard and display (alphanumeric, semi-graphic or graphic display). The entire family is 8086 compatible and the M216 also uses an 8086 microprocessor. The first Romanian home computer belongs to this category;

--Minicomputer type: I-100/103F, L106 (under development) and Coral 4001/4011/4021/430; the two families are MC compatible. The largest capacity units have a maximum of 4 M bytes internal memory. Development of a front-end minicomputer version is expected also;

--Computer type: Felix C512/1024, IRIS 50/60 compatible with 0.5/1 MB internal memory. Felix C8020 (under development), modern version, maximum storage capacity 8 M bytes, virtual storage possibility, continual remote processing capacity. (In the future we expect development of the ESR compatible Felix C8030 computer also.)

f. System Software

--Operating systems for microcomputers (SFDX);

--Operating systems for minicomputers (AMS, MINOS);

--Operating systems for computers; HELIOS, using virtual computer concept.

The operating systems include interpreters for all customary high level programming languages at the level of the most recent ISO standards: FORTRAN, COBOL, BASIC, PL/I, PASCAL, and a wide variety of auxiliary programs and applications programs (including mathematics programs).

The operating system for computers also includes program products for multiple conversational access and for database management systems.

g. Applications Program Products

The development of applications program products is coordinated by the Central Guidance and Information Institute, which belongs under the National Scientific and Technical Council. The computer industry has developed several categories of applications program products. One example of this is program products for computer aided design.

h. Specially developed systems for a broad sphere of industrial use on the basis of microprocessor and/or minicomputer processing (for example, fabric testing stations, dynamic truck weighing equipment, etc.).

i. Auxiliary Equipment

Voltage/frequency controlled energy development unit, air conditioning units, sensing and danger signalling units for fire prevention, for CO_2 fire extinguishing equipment, for floors and ceilings of technological locations.

We might include among the specialized services of the Romanian computer industry hardware and software instruction, hardware maintenance and instruction, consulting, system design, etc.

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